International Space Station Assembly Sequence

Date	Flight	Launch	Element(s)	Rationale
June 1998	1A/R	Russian	Functional Cargo Block	Provides propulsive control capability, fuel storage and rendezvous and docking capability to Service Module.
July 1998	2A	US	Node 1, Pressurized Mating Adapters	Provides interfaces between US and Russian elements.
Dec 1998	1R	Russian	Service Module	Provides environmental control and life support system functions.
Dec 1998	2A.1	US	Logistics	Adds margin and flexibility to assembly sequence.
Jan 1999	3A	US	Integrated Truss Structure, Pressurized Mating Adapter 3, Ku-band and Control Moment Gyros	Truss allows the temporary installation of the Photovoltaic module for early US-based power, Ku-band communication system supports early science capability, Pressurized Mating Adapter provides a shuttle docking for next flight, and Control Moment Gyros provide non-propulsive attitude control.
Jan 1999	2R	Russian	Soyuz	Permits initial station habitation with three-person crew, providing assured crew return capability.
March 1999	4A	US	Integrated Truss Structure, Photovoltaic module	Establishes initial Photovoltaic module based power capability.
May 1999	5A	US	Lab	Provides initial research capability.
June 1999	6A	US	Ultra High Frequency antenna and Space Station Remote Manipulating System	Antenna provides space-to-space communications capability for space walking, Remote Manipulating System required to perform assembly operations on later flights.
Aug 1999	7A	US	Joint Airlock and High Pressure Gas Assembly	Airlock provides station-based space walking capability and high pressuregas assembly augments the Service Module gas resupply system.
Oct 1999	7A.1	US	U.S. outfitting	Outfitting prior to beginning utilization flights.
Dec 1999	4R	Russian	Docking Compartment 1	Provides egress, ingress for Russian based space walks and a Soyuz docking port.
Jan 2000	UF-1	US		Payload resupply and/or changeout.
Feb 2000	8A	US	Integrated Truss Structure, Mobile Transporter	Integrated Truss Structure provides attachment and umbilicals between pressurized elements and permanent truss-mounted distributed system/utilities.
Mar 2000	UF-2	US		Payload resupply and/or changeout.
June 2000	9A	US	Integrated Truss Structure, Central Thermal Control System	Delivers the starboard Central Thermal Control System.
July 2000	9A.1	US	Power control with four solar arrays	Delivery of the Russian power/control mast with four solar arrays providing additional Russian power and delivers European Robotic Arm.
Oct 2000	11A	US	Integrated Truss Structure, Central Thermal Control System	Delivers the port Central Thermal Control System
Nov 2000	12A	US	Integrated Truss Structure,Photovoltaic module	Provides additional power.
Dec 2000	3R	Russian	Universal Docking Module	Provides docking locations for Russian Research Modules, Life Support Modules and a second docking compartment for Soyuz vehicles.
Dec 2000	5R	Russia	Docking Compartment 2	Replaces discarded Docking compartment 1.
Mar 2001	13A	US	Integrated Truss Structure, S-Band	provides additional power and S-Band capability
Apr 2001	10A	US	Node 2, Nitrogen tank assembly	Node 2 provides attach locations, establishes the primary docking location for the shuttle.
May 2001	1J/A	US	Integrated Truss Structure, Photovoltaic module	Lab outfitting.
Aug 2001	1J	US	Japanese Experiment Module	Japanese Experiment Module is delivered and activated.
Sept 2001	UF-3	US		Payload resupply and/or changeout.
Jan 2002	UF-4	US	Alpha Magnetic Spectrometer	Alpha Magnetic Spectrometer researches cosmic ray propagation.
Feb 2002	2J/A	US		Lab outfitting.
Feb 2002	9R.1	Russian	Docking and Stowage Module-1	Provides additional on-orbit stowage and a Soyuz docking location.
May 2002	9R.2	Russian	Docking and Stowage Module-2	Provides additional on-orbit stowage and a Soyuz docking location.
May 2002	14A	US	Cupola and Port Rails, Solar Arrays	Cupola provides direct viewing capability for some robotics operations and payload viewing.
June 2002	UF-5	US		Payload resupply and/or changeout
TBD	2E	US		Lab outfitting.
TBD	8R	Russian	Research Module 1	Provides Russian experiments and research facilities.
TBD	16A	US	Habitation	US Habitation module is delivered and activated.
TBD	10R	Russian	Research Module 2	Provides Russian experiments and research facilities.
TBD	17A	US	Habitation outfitting	Increases US Habitation module outfitting, providing basic habitation facilities for 4 US-based crew.
TBD	11R	Russian	Life Support Module 1	Life Support Module provides oxygen regeneration capability and other life support functions.
TBD	12R	Russian	Life Support Module 2	Second Life Support Module provides oxygen regeneration capability and other life support functions.
TBD	18A	US	Crew Return Vehicle	Crew Return Vehicle attached to the station providing a six-person crew return capability.
TBD	19A	US	Habitation outfitting	Completes US Habitation module outfitting.
TBD	15A	US	Photovoltaic module	Fourth US truss-based module completing the major power system elements.
TBD	UF-6	US		Payload resupply and/or changeout.
TBD	UF7	US	Centrifuge	Centrifuge Accommodations Module attached to Node 2 zenith port enhancing user capabilities.
TBD	1E	US	Columbus Orbital Facility	European Space Agency research facility provides additional research capability.

For Franklin Planner use: cut along bottom line. Place holes on right side, fold in half. Start of assembly should be in front.

New space station web site features details on assembly sequence

(Continued from Page 1)

first U.S.-built component, Node 1, will be delivered to the Kennedy Space Center this summer for pre-launch testing and processing. Node 1 will be launched on STS-88 in July 1998 to be mated to the already-orbiting Functional Energy Block. Because U.S. components such as the laboratory module, the first truss segment and the first solar array remain on schedule, NASA will take advantage of the extra time in assembly to pursue integrated testing of components after they are shipped to Kennedy Space Center.

"A little more than a year from now, we'll launch the first component. About a year and a half from now, we will launch the first crew. Only two years from today, that first crew will be finishing up the first tour onboard. Four shuttle assembly flights will already have been completed. And we'll be only a few months from completing Phase 2 of the program," Brinkley said. "This spacecraft is on deck, and we are number one on the runway."

Other highlights of the new schedule, called the International Space Station Assembly Sequence, Rev. C, include:

• In January 1999, the second space shuttle assembly mission, designated STS-92 and assembly Flight 3A, will be launched and later followed by a Russian Soyuz spacecraft carrying the first crew—International Space Station Commander Bill Shepherd, Soyuz Commander Yuri Gidzenko and Flight Engineer Sergei Krikalev—to begin a permanent human presence on the station.

• Two shuttle flights have been added to the assembly sequence to increase margin and add flexibility. The flights, called flight 2A.1 in late 1998 and flight 7A.1 in late 1999, may be used to offload cargo from adjacent assembly flights and assist with U.S. outfitting of the station.

• At present, NASA plans to continue the conversion of a Naval Research Laboratory stage into an Interim Control Module, that could be used to augment the station's future propulsion capabilities if needed by being attached to either the Functional Cargo Block or the Service Module.

• Assembly flight 13A, a mission that carries two additional solar arrays, has been realigned earlier in the assembly sequence and will provide additional power for scientific activities and station assembly.

• Launch date options for the European Space Agency's Columbus Orbital Facility remain under evaluation. While these options are analyzed, the launch dates for all flights after Utilization Flight 5 in June 2002 will remain under review; however, the U.S. Habitat Module will be fully outfitted by December 2002 regardless of the options chosen. These dates are expected to be set at a Space Station Control Board meeting in the fall of 1997.

A fact sheet on the new assembly sequence, graphics and other updated information on the International Space Station is available on the Internet in a preview of a new web site under development at: http://station.nasa.gov The assembly sequence itself is available at: http://station.nasa.gov/station/assembly/chron.html

Hubble's upgrades show stellar birth, death, details on black holes

Three months after an orbital house call by astronauts, new instruments on the Hubble Space Telescope are helping astronomers probe the universe in greater detail.

New data released by NASA this month include direct evidence of a supermassive black hole and remarkable new details on the explosive life cycle of stars. NASA also reported that all new Hubble instruments and upgrades are generally performing well.

"We're extremely excited about the quality and precision of the images from Hubble," said Wes Huntress, NASA associate administrator for Space Science. "Following check-out of the instruments, Hubble will return to full science operations, and we can expect a continuing flow of new and exciting discoveries."

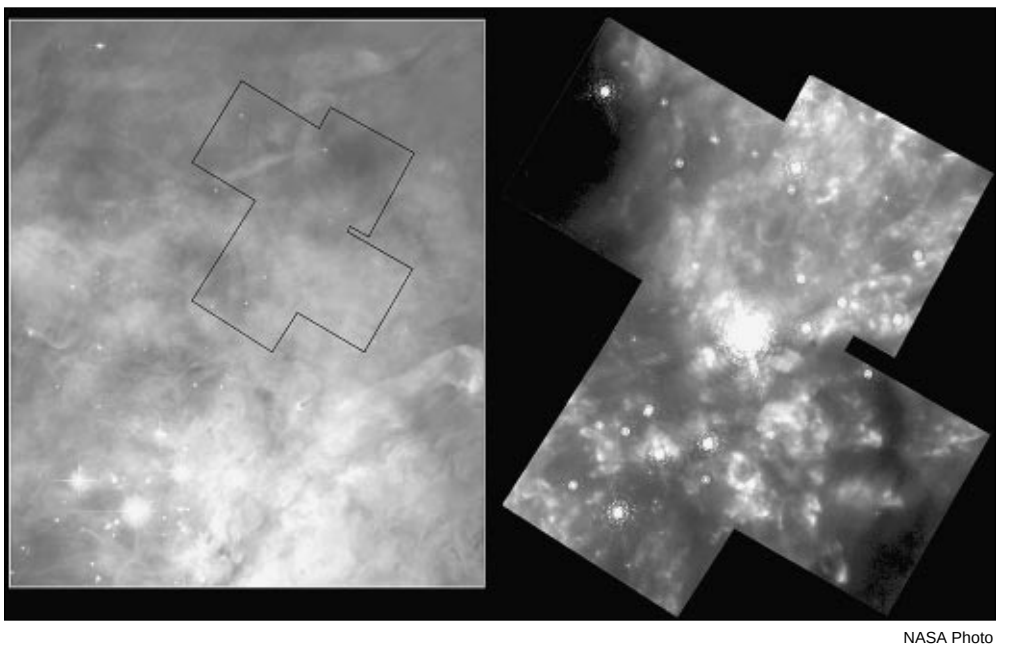
These initial results clearly demonstrate the ability of the new instruments to fulfill their science goals with the Hubble Telescope, say project astronomers. Project officials said other instruments and electronics installed during the second servicing mission are generally performing well.

Among Hubble's recent observations:

• Jets and Gaseous Disk Around the Egg Nebula—A new infrared instrument peered deep into the region around a dying star in the Egg nebula, 3,000 light years from Earth. The new images provide a clear view of a twin pair of narrow bullet-shaped "jets" of gas and dust blasted into space. The Near Infrared Camera and Multi-Object Spectrometer also revealed an unusual scalloped edge along a doughnut-shaped molecular hydrogen cloud.

• Unveiling Violent Starbirth in the Orion Nebula—The new infrared instrument penetrated the shroud of dust along the back wall of the Orion nebula, located in the "sword" of the constellation Orion. Data revealed what can happen to a stellar neighborhood when massive young stars begin to violently eject material into the surrounding molecular cloud. Hubble reveals a surprising array of complex structures, including clumps, bubbles, and knots of material. Most remarkable are "bullets" composed of molecular hydrogen—the fastest of which travels at more than one million miles an hour. These bullets are colliding with slower-moving material, creating bow shocks, like a speedboat racing across water.

• Monster Black Hole in Galaxy M84—In a single exposure, a new powerful instrument called the Space Telescope Imaging Spectrograph discovered a black hole at least 300 million times the mass of the Sun. The spectrograph made a precise observation along a narrow slit across the center of galaxy M84, located 50 million light-years away. This allowed the instrument to measure the increasing velocity of a disk of gas orbiting the black hole. To scientists, this represents the signature of a black hole, among the most direct evidence obtained to date.



NASA Photo

This infrared vision from the Hubble Space Telescope's Near Infrared Camera and Multi-Object Spectrometer is providing a dramatic new look at the Orion Nebula which contains the nearest nursery for massive stars. For comparison, Hubble's Wide Field and Planetary Camera 2 image on the left shows a large part of the nebula as it appears in visible light. The new infrared vision reveals an active star birth region.

• Composition and Structure of the Ring Around Supernova 1987A—The new spectrograph also provides an unprecedented look at a unique and complex structure in the universe—a light-year-wide ring of glowing gas around Supernova 1987A, the closest supernova explosion in 400 years. The spectrograph dissects the ring's light to tell scientists which elements are in the ring and helps paint a picture of the physics and stellar processes which created the ring.

NASA officials report that other upgrades to Hubble are performing well, including the newly installed solid state recorder, fine guidance sensor and solar array drive electronics.